Supplementary Movie Legends

Movie S1. Electron cryotomography of *Treponema primitia*: cell #1.
A movie showing the digital slices through a tomographic volume of cell #1 and then the segmented surfaces of the cell. The components are labeled.

Movie S2. Electron cryotomography of *Treponema primitia*: cell #2.
A movie of the connected cells #2a and #2b showing the digital slices through the volume and the segmented surfaces.

Movie S3. The periplasmic cone of *Treponema primitia*: cell #1.
A movie that focuses on the periplasmic cone. The digital slices of the volume are shown, followed by an isosurface of the porous cone.

Movie S4. Cross section of a *T. primitia* cell displaying a bilaminar periplasmic layer.
Cross sections of cell #8 proceed from the tip down the length of the cell and show a bilaminar periplasmic layer on the left hand side. The flagella wrap around the cell. At the cell tip, a flagellum lies at the bottom right hand side, but towards the middle, the two flagella lie on the left hand side.

Movie S5. *Treponema primitia* ZAS-2 motility.
A cell swims at ~12 microns/second in a ~4 cP viscous salt solution, which is not much more viscous than water. The movie is shown half as fast as the real time data, which was collected at 10 ms per frame. Notice that the cell remains a rigid helix throughout, instead of bending. How this spirochete can coordinate the reciprocal rotation of the motors at either end is unknown.

Movie S6. A "rolling cylinder" model for *Treponema primitia* motility.
An explanation for motility as proposed in the discussion section is shown graphically.